Evaluation of the Multifunction Cardiogram(MCG) for Low Risk Chest Pain Patients Presenting to the Emergency Department

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Study Objectives:

Emergency physicians (EPs) world-wide could benefit from a non-invasive, cost-effective, and accurate tool to determine which patients with suspected acute coronary syndrome (ACS) have significant coronary obstruction. A novel computerized, multiphase, resting electrocardiogram analysis device, the Multifunction Cardiogram (MCG), takes the traditional 12-lead ECG and combines it with mathematical modeling and functional measurements of the heart's electrical activity.

Independent studies in patients with high risk coronary artery disease have shown the MCG to have a high correlation with coronary stenosis confirmed by angiography. The objective of this case series was to describe the application of the MCG to low risk chest pain patients with suspected ACS presenting to the ED and compare results to angiography.

Methods:

This prospective study enrolled a convenience sample of adult patients presenting to a tertiary care academic teaching center with chest pain in whom the EP suspected low risk ACS. Patients with ECGs showing active ischemia (including STEMI and NSTEMI) and those unable to complete follow-up were excluded. After evaluation by the EP and obtaining informed consent, an MCG was performed. To obtain the MCG reading, data from two traditional ECG leads, lead II and V5, were collected for 82 seconds, and 3-5 tests were performed on each patient. MCG results were electronically transmitted to a central computer where the data was mathematically transformed and analyzed to identify distinct functional indices. A risk score ranging from 0 (minimal risk) to 20 (very high risk) was provided. The EP was blinded to the results of the MCG and the results did not change medical management.

Outcome was based on the results of the coronary angiogram, either Coronary Computed Tomography Angiography (CCTA) or conventional angiography. Angiogram results were classified as no coronary artery disease (CAD), mild CAD, moderate CAD and severe CAD based on the degree of stenosis visualized by the cardiologist.

Results:

There were 511 patients enrolled with a mean age was 52 (SD23) and 51% were female. 1% were Asian, 18% Hispanic, 33% African American and 47% White. Of these, 47 patients (9%) had an angiogram performed (63% CCTA): 23 (49%) had no CAD, 12(26%) had mild CAD,

7 (15%) had moderate CAD, and 5 (11%) had severe CAD. The mean MCG score for patients with no CAD was 2.3 (95% CI 1.0-3.1), mild 2.6 (95% CI 0.8-4.3), moderate 3.4 (95% CI 1.2-5.6) and severe 4.8 (95% CI 1.4-8.2). Angiogram results were dichotomized into severe and non-severe. Mean MCG scores in patients with severe CAD was 4.8 (95% CI 1.4-8.2) compared to non-severe CAD 2.4 (95% CI 1.6-3.2)(p=0.046). The mean of the highest MCG score was 6.8 (95% CI 4.3-9.3) for severe CAD and 3.1 (95% CI 2.2-4.0) for non-severe CAD (p=0.006). The area under the ROC curve (AUC) for predicting severe CAD was 0.76 (95% CI 0.57-0.95) using the average MCG score and 0.85 (95% CI 0.70-0.99) using the highest MCG score. The sensitivity of the highest MCG score for predicting severe disease using an index score of 4 or greater was 100% (95% CI 46-100), specificity was 56% (95% CI 40-71), negative predictive value 100% (95% CI 82-100) and likelihood ratio 2.3 (95% CI 1.6-3.2).

Conclusions:
MCG scores increased with severity of coronary obstruction. This study introduces the MCG as a potential tool for assessing low risk chest pain patients with suspected ACS in the ED. A large prospective multicenter study is ongoing.